

Subject:- Mechanical Operation

Assignment:-01

- 1) Differentiate unit operation and unit process.
- 2) Define:- 1.sphericity 2.specific surface area 3.volume surface mean diameter  
4.massMean diameter 5.Bulk density 6.Shape factor 7.Number of particles in mixture  
8.equivalent diameter

Assignment:-02

- 1) Describe types of screen briefly.
- 2) Write a note on types of screen analysis.
- 3) Write short note on Capacity & effectiveness of screen.
- 4) Discuss factor affecting effectiveness and capacity of screen
- 5) Give difference between Actual and Ideal screen.
- 6) Derive formula for overall effectiveness of screen
- 7) "Capacity and effectiveness of screen are opposite factors"- Explain.
- 8) Write a short note on Trommels, Grizzlies, Vibrating screen.

Assignment:-03

- 1) List out various size reduction equipment as per their principal
- 2) Describe the crushing laws and explain all in detail
- 3) Explain Rittingers, Kicks and Bonds Laws along with their applications.
- 4) Define work index
- 5) Differentiate open and close circuit grinding with neat flow diagram.
- 6) Describe Crushing Efficiency and Mechanical Efficiency.
- 7) Explain principal, construction and working of Gyratory crusher.
- 8) List out the factors consider for selection of mixing equipment
- 9) Discuss Energy and power requirement in comminution.
- 10) Describe Construction and working of Fluid Energy mill. .
- 11) Describe construction and working of Jaw crusher with sketch
- 12) Explain : 1)Jaw crusher, 2)Ribbon blender, 3)Roll crusher
- 13) Derive equation for angle of nip in roll crusher.
- 14) What is critical speed? Derive equation of critical speed for Ball mill
- 15) Explain principal construction and working of Gyratory crusher

Assignment:-04

- 1) Define sedimentation and Explain theory of Batch Sedimentation. Give interphase height and time curve.
- 2) Discuss principle,construction and working of cyclone separator.
- 3) Explain terminal settling velocity, Stocks' law and Newton's law.
- 4) Differentiate :- Sedimentation vs filtration
- 5) Construction and working of Tubular centrifuge

Assignment:-05

- 1) Explain plate and frame filter press with sketch
- 2) What are the advantages and dis advantages of centrifuge over filter press.
- 3) Explain constant rate filtration and constant pressure filtration.
- 4) Explain: Construction and working of disk centrifuge
- 5) Write Principle, construction and working of Rotary vacuum filter with sketch.
- 6) Write Principle, construction and working of batch centrifuge with sketch.

- 7) Write short note on filter aid and filter media.
- 8) Describe Principle, construction and working of cartridge filter.
- 9) Explain principle, construction and working of Gravity thickener.

**Assignment:-06**

- 1) Write a note on electrostatic precipitator.
- 2) Explain Working principle of a) Jigging b) Elutriation c) Froth flotation cell
- 3) d) Electrostatic precipitator
- 4) Explain principle, construction and working of Magnetic Separator.
- 5) Explain sink and float method for separation of solid particles.
- 6) Explain : Differential settling methods.
- 7) Write a short note on Sink and Float method

**Assignment:-07**

- 1) Define Agitation and mixing, and give their applications.
- 2) Differentiate :- Agitation vs mixing .
- 3) Factors affecting selection of mixing equipments
- 4) Calculations of power consumption in baffled and unbaffled tank
- 5) Explain agitation vessel with principle, working and construction.
- 6) Give classification of impellers used in agitation and mixing.
- 7) Explain methods Vortex formation and methods of Vortex prevention.
- 8) Write short note on Rate of mixing and mixing index.
- 9) Derive the equation for power consumption in Agitation.
- 10) Describe swirling and vortex formation
- 11) Describe methods to reduce vortex formation.
- 12) Construction and working of
  - a) Ribbon blender
  - b) Kneaders
  - c) Pug mill
  - d) Banbury mixer
  - e) Muller mixer

**Assignment:-08**

1) While analyzing 100 gms. Sand sample by testing sieves, the following Observation were recorded.

Clear opening(cms)	Material retained(gms)
0.4690	0.0
0.3327	18.00
0.2362	29.00
0.1651	36.00
0.1168	17.00

Calculate the specific surface area and volume surface mean diameter for this Sample. Specific gravity of particles=2.65, Sphericity  $Q_s=0.571$ .

2) Soil containing 14% moisture was mixed in large Muller mixer with 10.00 wt % of a tracer consisting of dextrose & picric acid. After 3 minute of mixing 12 random samples were taken from the mixture & analyzed colorimetrically for tracer material. The measured concentration in the sample was in weight % tracer 10.24, 9.30, 7.94, 10.24, 11.08, 10.03, 11.91, 9.72, 9.20, 10.76, 10.97, 10.55. Calculate the mixing index  $I_p$ .

3) A screen of 10 mesh size made up of 0.1 cm thick wire is used for size separation. The ratio of overflow to underflow obtained is 0.75. The analysis of two friction show the overflow contains 89% oversize material and the underflow contains 27 % oversize material.

1. Calculate the percentage of oversize and undersize in feed.
2. Calculate the efficiency based on combined effectiveness.

4) Calculate the power required to crush 50 tons/hr. of Bauxite if 80% of feed passes 3 in. screen and 80% of product passes 0.5 in. screen. The work index is 8.78.

5) What speed of rotation in revolution per minute would you recommend for a ball mill 1200 mm in diameter with 75 mm balls?

6) A flat blade turbine is installed centrally in a vertical tank. The tank is 1.83 m in diameter. The turbine is 0.60 m in dia. and positioned 0.60 m from the bottom of the tank. The turbine blades are 127 mm wide. The tank is filled to a depth of 1.83 m with a solution of 50% caustic soda at 66 oC which has a viscosity of 12 cp and density of 1498 kg/m<sup>3</sup>. The turbine is operated at 90 rpm. The tank is baffled. What will be power required to operate the turbine? Power no.= 5.8.

7) From analysis of feed, overflow and underflow of a quartz mix from a 10 mesh screen, the following data is collected,

Mass fraction of oversize material in overflow (XD) = 0.9

Mass fraction of oversize material in feed (XF) = 0.6

Mass fraction of oversize material in underflow (XB) = 0.4

Calculate overall effectiveness of screen and mass ratios of overflow and underflow to feed.

8) A flat blade turbine with six blades is installed centrally in vertical tank.

The tank is 1.63 m in diameter and the turbine diameter is 0.51 m and positioned at 0.51 m above the bottom of the tank. Calculate the power required for agitation. Density of solution = 1150 kg/m<sup>3</sup>,

Viscosity of solution = 1.2 cP, speed of impeller = 1.5 rps, baffle width = 19cm.

<b>NRE</b>	10,000	50,000	80,000
<b>Power number, Np</b>	5.8	6.2	6.2

9) Calculate specific surface area of the following fraction of particles.

<b>Mesh opening, mm</b>	<b>Differential weight fraction</b>
-1+0.5	0.1
-0.5+0.25	0.25
-0.25+0.1	0.35
-0.1+0.05	0.20
-0.05+0.01	0.10

Shape factor = 0.2, Density = 0.002 gm/mm<sup>3</sup>

10) Find the critical speed of ball mill, if diameter of mill is 800 mm and diameter of balls is 80 mm.

11) A screen of 10 mesh size made up of 0.1 cm thick wire is used for size separation. The ratio of overflow to underflow obtained is 0.75. The analysis of two fraction show the overflow contains 89 % oversize material & underflow contains 27 % oversize material.

- Calculate the percentage oversize & undersize in feed.
- Calculate the efficiency based on combined effectiveness

12) A certain crusher accepts a feed material having a volume surface mean diameter of 19 mm & gives a product of volume surface mean diameter of 5 mm. The power required to crush 18 tons per hour is 10 hp. What will be the power consumption if capacity is reduced to 15 tons per hour?

13) Find out the critical speed of ball mill using following data  
Diameter of ball mill = 450mm Diameter of ball = 25 mm

14) What will be power required to crush 100 tonnes per hour of limestone if 80 percent of feed passes 50 mm screen and 80 percent of product of 3.125 mm screen? The work index of limestone = 12.74

15) The screen analysis shown in table applies to a sample of crushed quartz. The density of particles is 0.00265 g /mm<sup>3</sup> and the shape factor are  $a = 2$  And  $\phi_s = 0.571$ . For material between 4-mesh and 200-mesh in particle size, calculate

- Specific surface of mixture
  - Number of particles in mixture
- Exclude pan fraction.

<b>Mesh Number</b>	6	10	20	48
<b>Screen Opening, mm</b>	3.327	1.651	0.833	0.259
<b>Mass fr. retained</b>	0.0251	0.4457	0.4160	0.0850

<b>Mesh Number</b>	100	200	pan
<b>Screen Opening, mm</b>	0.147	0.074	--
<b>Mass fr. Retained</b>	0.0135	0.0072	0.0075